What is claimed is:

1. A method for agent-based operation of a robotic device, said method comprising:

detecting at least one condition in various locations of a room with a plurality of sensors;

in a plurality of agents associated with respective areas of the room, the plurality of agents

being configured to control at least one condition in the respective associated areas, receiving

sensed data from at least one of the plurality of sensors, determining whether the received sensed

data are outside of respective predetermined ranges, and transmitting information to the robotic

device related to the sensed data in response to the sensed data being outside of the

predetermined ranges;

in the robotic device, processing the information received from one or more of the

plurality of agents to determine whether components of a cooling system are to be manipulated to

vary a characteristic of cooling fluid supplied to the various locations of the room.

2. The method according to claim 1, further comprising:

in the plurality of agents, determining a deviation of the sensed data from the respective

predetermined ranges; and

wherein the step of transmitting information to the robotic device comprises transmitting

information pertaining to the deviation of the sensed data from the respective predetermined

ranges.

3. The method according to claim 2, further comprising:

in the robotic device, processing the information pertaining to the deviation of the sensed

data from the respective predetermined ranges and increasing cooling fluid flow to the associated

areas of the one or more agents that transmitted information indicating that the deviation of the

sensed data from the respective predetermined ranges exceeds the respective predetermined

ranges, and

4. The method according to claim 2, further comprising:

in the robotic device, processing the information pertaining to the deviation of the sensed

data from the respective predetermined ranges and decreasing cooling fluid flow to the associated

areas of the one or more agents that transmitted information indicating that the deviation of the sensed data from the respective predetermined ranges falls below the respective predetermined ranges.

5.   The method according to claim 2, further comprising:

in the robotic device, processing the information pertaining to the deviation of the sensed data from the respective predetermined ranges and decreasing cooling fluid flow to the associated areas of the one or more agents that transmitted information indicating that the deviation of the sensed data from the respective predetermined ranges exceeds the respective predetermined ranges.

6.   The method according to claim 2, further comprising:

in the robotic device, processing the information pertaining to the deviation of the sensed data from the respective predetermined ranges and increasing cooling fluid flow to the associated areas of the one or more agents that transmitted information indicating that the deviation of the sensed data from the respective predetermined ranges falls below the respective predetermined ranges.

7.   The method according to claim 1, further comprising:

in the robotic device, detecting at least one condition; and

wherein the step of processing the information received from one or more of the plurality of agents to determine whether components of a cooling system are to be manipulated further comprises processing the detected at least one condition to determine whether components of a cooling system are to be manipulated to vary a characteristic of cooling fluid supplied to the various locations of the room.

8.   The method according to claim 1, further comprising:

in the plurality of agents, determining which cooling system components to manipulate and a manner in which to manipulate the determined cooling system components, wherein the step of transmitting information to the robotic device comprises transmitting information

pertaining to which cooling system components to manipulate and a manner in which to manipulate the determined cooling system components;

in the robotic device, processing the information received from the plurality of agents and determining which of the requested manipulations to accept.

9. The method according to claim 1, further comprising:

in the robotic device, transmitting control signals to one or more cooling system components to vary cooling fluid delivery to areas of the room associated with the one or more agents that indicated that the sensed data are outside of the predetermined ranges.

10. The method according to claim 1, wherein the step of processing the information received from one or more of the plurality of agents to determine whether components of a cooling system are to be manipulated to vary a characteristic of cooling fluid supplied to the various locations of the room further comprises determining whether an output of an air conditioning unit of the cooling system is to be manipulated; and

transmitting control signals to the air conditioning unit to vary at least one of cooling fluid temperature and output in response to a determination to manipulate the air conditioning unit.

11. The method according to claim 1, further comprising:

in the plurality of agents, determining a deviation of the sensed data from the respective predetermined ranges; and

wherein the step of transmitting information to the robotic device comprises transmitting at least one of a buy bid and a sell offer for cooling resources in response to the determined deviation of the sensed data from the respective predetermined ranges, wherein the step of transmitting a buy bid comprises transmitting a buy bid in response to the determined deviation of the sensed data exceeding the respective predetermined ranges and wherein the step of transmitting a sell offer comprises transmitting a sell offer in response to the determined deviation of the sensed data falling below the respective predetermined ranges.

12.   The method according to claim 11, wherein the step of transmitting at least one of a buy bid and a sell offer for cooling resources comprises pricing the at least one of a buy bid and a sell offer according to the deviation of the sensed data from the respective predetermined ranges.

13.   The method according to claim 12, further comprising:

in the robotic device, comparing the at least one of a buy bid and a sell offer transmitted from the plurality of agents to determine which of the buy bids and sell offers to accept.

14.   The method according to claim 13, wherein the step of comparing the at least one of a buy bid and a sell offer comprises giving greater weight to those buy bids and sell offers transmitted from the plurality of agents located in greater proximity to the robotic device at the time the at least one of a buy bid and a sell offer was transmitted to the robotic device.

15.   The method according to claim 13, wherein the plurality of agents are classified in an hierarchical manner; and

wherein the step of comparing the at least one of a buy bid and a sell offer comprises giving greater weight to those buy bids and sell offers transmitted from those agents having a higher classification in the hierarchy of agents.

16.   The method according to claim 13, wherein the step of comparing the at least one of a buy bid and a sell offer comprises determining which of a plurality of buy bids to accept and which of a plurality of sell offers to accept according to market-based considerations.

17.   The method according to claim 16, wherein the step of determining which of a plurality of buy bids to accept and which of a plurality of sell offers to accept according to market-based considerations comprises basing a decision to accept one or more of the plurality of buy bids on respective prices of the plurality of buy bids and basing a decision to accept one or more of the plurality of sell offers on respective prices of the plurality of sell offers.

18. The method according to claim 13, wherein the step of comparing the at least one of a buy bid and a sell offer comprises determining which of a plurality of buy bids to accept and which of a plurality of sell offers to accept according to predefined objectives of the robotic device.

19. The method according to claim 18, wherein the predefined objectives of the robotic device comprises maintaining the costs associated with maintaining locations of the room within predefined amounts.

20. The method according to claim 13, further comprising:

controlling one or more cooling system components to manipulate cooling fluid delivery to areas associated with agents whose buy bids or sell offers have been accepted by the robotic device.

21. The method according to claim 1, further comprising:

in the robotic device, determining whether to manipulate one or more cooling resources comprising of computing resource, a rack inlet airflow controller, a vent tile, a CRAC fan flow, and a CRAC temperature in response to the information received from the agents.

22. The method according to claim 21, wherein the robotic device is configured to manipulate the one or more cooling resources according to the hierarchy of the cooling resource, said hierarchy being based on the energy cost associated with the respective cooling resource.

23. The method according to claim 1, further comprising:

in the plurality of agents, determining whether to manipulate one or more of computing resource, a rack inlet airflow controller, a vent tile, a CRAC fan flow, and a CRAC temperature in response to the sensed data received from the sensors.

24.   The method according to claim 23, wherein the robotic device is configured to manipulate the one or more cooling resources according to the hierarchy of the cooling resource, said hierarchy being based on the energy cost associated with the respective cooling resource.

5   25.   A system for agent-based operation of a robotic device, said system comprising:
        a plurality of sensors for detecting at least one condition at various locations of a room;
        one or more agents associated with respective areas of the room, said one or more agents configured to control at least one condition in the respective associated areas, said one or more agents being further configured to receive sensed data from at least one of the plurality of
10   sensors, the one or more agents being configured to determine whether the received sensed data are outside of respective predetermined ranges;
        a robotic device configured to maneuver around the room and to communicate with the one or more agents;
        a cooling system having a plurality of cooling system components configured to vary at
15   least one characteristic of cooling fluid delivery to the various locations of the room; and
        wherein the robotic device is configured to manipulate at least one of the plurality of cooling system components in response to a communication from the one or more agents that at least one detected condition is outside predetermined ranges.

20   26.   The system according to claim 25, wherein the one or more agents are classified in an hierarchical manner, and wherein those of the one or more agents having lower classifications are configured to control at least one condition in smaller areas of the room than those of the one or more agents having the higher classifications.

25   27.   The system according to claim 25, wherein the one or more agents are configured to determine which cooling system components to manipulate and a manner in which to manipulate the determined cooling system components, said one or more agents being further configured to transmit the determined cooling system components to manipulate and the manner in which to manipulate the determined cooling system components to the robotic device.

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28.   The system according to claim 25, wherein the one or more agents are configured to determine a deviation of the received sensed data from the respective predetermined ranges and to communicate the deviation of the received sensed data to the robotic device to thereby request modifications in cooling resource distribution.

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29.   The system according to claim 28, wherein the robotic device is configured to compare the requests for modifications in cooling resource distribution communicated from the one or more agents to determine which of the requests to accept and deny, and wherein the robotic device is further configured to manipulate the cooling resource distribution in response to

10   the accepted requests.

30.   The system according to claim 29, wherein the robotic device is configured to determine which of the requests to accept and deny according to market-based considerations.

15   31.   The system according to claim 30, wherein the robotic device is configured to allocate wealth to the one or more agents and associate prices for requests for modifications in cooling resource distribution submitted by the one or more agents.

32.   The system according to claim 29, wherein the robotic device is configured to

20   determine which of the request to accept and deny according to predefined objectives of the robotic device.

33.   The system according to claim 28, wherein the robotic device comprises a sensor configured to detect at least one condition, said robotic device being configured to employ the

25   sensed data obtained from the sensor in determining which of the requests from the one or more agents to accept or deny.

34.   The system according to claim 25, wherein the robotic device is configured to perform a numerical modeling of airflow characteristics in the room to determine manners of

30   manipulating the at least one of the plurality of cooling system components.

35. The system according to claim 25, wherein the plurality of cooling system components includes one or more of cooling resource distribution, rack inlet airflow controllers, vent tiles, CRAC fan, and CRAC airflow temperature controller.

36. A system for agent-based operation of a robotic device means, said system comprising:

means for detecting at least one condition in various locations of a room;

agent means for controlling at least one condition in the various locations of the room, said means for controlling having means for receiving sensed data from the means for detecting, said agent means for controlling further having means for determining whether the received sensed data are outside of respective predetermined ranges, and means for transmitting information to the robotic device means related to the sensed data in response to the sensed data being outside of the predetermined ranges;

in the robotic device means, means for processing the information received from the means for controlling to determine whether components of a cooling system are to be manipulated to vary a characteristic of cooling fluid supplied to the various locations of the room.

37. The system according to claim 36, wherein the agent means for controlling includes means for determining a deviation of the sensed data from the respective predetermined ranges; and

wherein the means for transmitting information to the robotic device means comprises means for transmitting information pertaining to the deviation of the sensed data from the respective predetermined ranges.

38. The system according to claim 37, wherein the robotic device means includes means for processing the information pertaining to the deviation of the sensed data from the respective predetermined ranges and means for varying cooling fluid flow to the associated areas of the agent means for controlling that transmitted information indicating that the deviation of the

sensed data from the respective predetermined ranges are outside of the respective predetermined ranges.

39.   The system according to claim 36, wherein the robotic device means includes means for transmitting control signals to one or more cooling system components to vary cooling fluid delivery to areas of the room associated with the agent means for controlling that indicated that the sensed data are outside of the predetermined ranges.

40.   The system according to claim 36, wherein the agent means for controller includes means for determining a deviation of the sensed data from the respective predetermined ranges; and
means for transmitting at least one of a buy bid and a sell offer for cooling resources in response to the determined deviation of the sensed data from the respective predetermined ranges, wherein the means for transmitting a buy bid comprises means for transmitting a buy bid in response to the determined deviation of the sensed data exceeding the respective predetermined ranges and means for transmitting a sell offer comprises means for transmitting a sell offer in response to the determined deviation of the sensed data falling below the respective predetermined ranges.

41.   The system according to claim 40, wherein the robotic device means includes means for allocating wealth to the agent means for controlling and wherein the agent means for controlling includes means for pricing the at least one of a buy bid and a sell offer according to the deviation of the sensed data from the respective predetermined ranges and wealth allocated to the agent means for controlling.

42.   The system according to claim 41, wherein the robotic device means comprises means for comparing the at least one of a buy bid and a sell offer transmitted from the agent means for controlling to determine which of the buy bids and sell offers to accept.

43. / A computer readable storage medium on which is embedded one or more computer programs, said one or more computer programs implementing a method for agent-based operation of a robotic device, said one or more computer programs comprising a set of instructions for:

5   detecting at least one condition in various locations of a room with a plurality of sensors;

in a plurality of agents associated with respective areas of the room, the plurality of agents being configured to control at least one condition in the respective associated areas, receiving sensed data from at least one of the plurality of sensors, determining whether the received sensed data are outside of respective predetermined ranges, and transmitting information to the robotic

10   device related to the sensed data in response to the sensed data being outside of the predetermined ranges;

in the robotic device, processing the information received from one or more of the plurality of agents to determine whether components of a cooling system are to be manipulated to vary a characteristic of cooling fluid supplied to the various locations of the room.

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44.   The computer readable storage medium according to claim 43, said one or more computer programs further comprising a set of instructions for:

in the plurality of agents, determining a deviation of the sensed data from the respective predetermined ranges; and

20   transmitting information pertaining to the deviation of the sensed data from the respective predetermined ranges to the robotic device.

45.   The computer readable storage medium according to claim 43, said one or more computer programs further comprising a set of instructions for:

25   in the robotic device, processing the information pertaining to the deviation of the sensed data from the respective predetermined ranges and varying cooling fluid flow to the associated areas of the one or more agents that transmitted information indicating that the deviation of the sensed data from the respective predetermined ranges are outside of the respective predetermined ranges.

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46. The computer readable storage medium according to claim 43, said one or more computer programs further comprising a set of instructions for:

in the robotic device, detecting at least one condition; and

wherein the step of processing the information received from one or more of the plurality of agents to determine whether components of a cooling system are to be manipulated further comprises processing the detected at least one condition to determine whether components of a cooling system are to be manipulated to vary a characteristic of cooling fluid supplied to the various locations of the room.

47. The computer readable storage medium according to claim 43, said one or more computer programs further comprising a set of instructions for:

in the plurality of agents, determining which cooling system components to manipulate and a manner in which to manipulate the determined cooling system components, wherein the step of transmitting information to the robotic device comprises transmitting information pertaining to which cooling system components to manipulate and a manner in which to manipulate the determined cooling system components;

in the robotic device, processing the information received from the plurality of agents and determining which of the requested manipulations to accept.

48. The computer readable storage medium according to claim 43, said one or more computer programs further comprising a set of instructions for:

in the one or more agents, determining a deviation of the sensed data from the respective predetermined ranges; and

transmitting at least one of a buy bid and a sell offer for cooling resources in response to the determined deviation of the sensed data from the respective predetermined ranges, wherein the step of transmitting a buy bid comprises transmitting a buy bid in response to the determined deviation of the sensed data exceeding the respective predetermined ranges and wherein the step of transmitting a sell offer comprises transmitting a sell offer in response to the determined deviation of the sensed data falling below the respective predetermined ranges.

49.   The computer readable storage medium according to claim 48, said one or more computer programs further comprising a set of instructions for:

in the robotic device, allocating wealth to the one or more agents; and

in the one or more agents, pricing the at least one of a buy bid and a sell offer according to

5   the deviation of the sensed data from the respective predetermined ranges and wealth allocated to the one or more agents.

50.   The computer readable storage medium according to claim 49, said one or more computer programs further comprising a set of instructions for:

10   controlling one or more cooling system components to manipulate cooling fluid delivery to areas associated with agents whose buy bids or sell offers have been accepted by the robotic device.

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